Fountains of FIRE

By Col Joe Corso, Kirtland AFB, N.M.

The recent eruption of Mt.St. Helens in Washington State and the prospects of other imminent eruptions focus needed attention on a very serious hazard: airborne volcanic ash. Normally, ash will be localized and can be avoided with careful attention and planning by aircrews and weather briefers. However, when ash is present at upper flight levels, unpredictable global dispersal can occur and play havoc with air traffic.

This happened when Mt. Redoubt erupted in Alaska in 1989. A Boeing 747-400 suffered a four-engine flameout and severe damage when it encountered an ash cloud. After Mt. Pinatubo erupted in 1991, at least 15 aircraft reported significant damage in spite of widespread warnings. Following the last Mt. St. Helens event, a C-130 inadvertently penetrated an ash plume 2 and a half hours after the second major eruption. The C-130 sustained extensive damage and recovered with only two of its engines still operating. In 1997, Mt. Popocatepetl erupted in Mexico. Several aircraft experienced minor damage from this eruption continuing into 1998. One aircrew experienced such reduced visibility for landing that they had to use the side windows on the flight deck in order to taxi after landing. The main point is this: Volcanic ash is a formidable menace and aircrews must take deliberate avoidance measures to escape its effects. The following information should help you avoid ash.

If flight planning in the vicinity of volcanic activity, contact base weather for current and forecast ash cloud positions and stay at least 20 Nautical Miles (NM) away. If possible, maneuver upwind of a volcanic plume, even when flying outside 20 NM. Carefully review Notices to Airmen or NOTAMS and Air Traffic Control (ATC) directives for current status, to include Volcanic Ash Advisory Statements (VAAS) recently developed by International Civil Aviation Organization (ICAO). Avoid destinations in areas of ash fallout.

There are many things to consider during preflight in a volcanic ash-covered environment. Perform a careful inspection of the following areas: pitot tubes and static ports; engine and ventilation inlets; air scoops; gear struts; and hydraulic actuator chrome. It is important to not wipe, rub, or walk on ash-coated surfaces (i.e., top of fuselage, wings, and/or horizontal stabilizer). Do not use windshield wipers to remove dust. Instead, flush off with water and wipe with a soft cloth.

For ground operations in a volcanic ash-covered environment: minimize operations; do not use the auxiliary power unit for air conditioning; restrict use to engine starts; once engines are started, use engine bleed for air conditioning; run air conditioning at full cold setting if dust becomes visible; do not use air conditioning packs during takeoff; if odors become present, minor eye irritation can be expected; remove contact lenses and consider the use of oxygen when odors or eye irritation occur; minimize thrust during taxi; and, if possible, perform a rolling takeoff.

During flight operations don't forget that: Airborne radar will not detect volcanic dust clouds; weather forecasts are occasionally wrong; and other clouds may hide plumes. In instrument meteorological conditions or at night, it may be difficult to determine if you're in an ash cloud or in regular clouds. It is for reasons like this that the ICAO spearheaded an effort to make information on volcanic hazards to aircraft more readily available. The ICAO has established Volcanic Ash Advisory Centers or VAACs that issue VAAS to aircrews.

The VAAS provides critical information for flight; however, aircrews can still enter ash clouds inadvertently. If that does happen, one of the telltale signs that you are in one is that your windscreen will become pitted so severely that it becomes translucent. The abrasive cloud particles will also sandblast the aircraft. In addition, airspeed indication may fluctuate greatly or appear unusually high or low due to volcanic dust blocking the pitot static system. Be pre-

pared for this by knowing the pitch/power settings indicated in the performance manual for "Flights with Unreliable Airspeed."

Other telltale signs you are in an ash cloud include: An acrid odor similar to electrical smoke; a rise in oil temperature, indicating dust-plugged oil cooler(s); increasing exhaust gas temperature; torching from the tailpipe; and volcanic ash or dust blowing into the cockpit through the air conditioning system.

At night telltale signs can be: St. Elmo's fire and static discharges visible around the windshield; a bright orange glow in the engine inlets; landing lights that cast dark distinct shadows (unlike the fuzzy, indistinct shadows that are cast against weather clouds); engines that surge and/or lose thrust as a result of dust buildup and blockage of the high pressure turbine nozzle guide vanes and the high pressure turbine cooling holes.

When you first encounter an ash cloud, select idle power if the situation permits. This will minimize erosion, glazing, and dust buildup. Consider an immediate 180-degree turn to get back to clear air. With prolonged exposure, engines may flame out due to erosion, blockage, or air starvation. If that happens, follow restart guidance and be prepared for delayed start and spool-up. After a suspected encounter, advise the nearest ATC agency and transmit a pilot report to the nearest military base via pilot-to-metro service. This is extremely important so that other aircrews can be warned in a timely manner.

Knowing how to land in a volcanic ash-covered environment can be quite helpful as well. Ash may act similar to dry snow or loose sand. In dry conditions, it is subject to vortices from engines, which may cause ingestion and subsequent damage. In wet conditions, ash-covered ramps, taxiways, and runways should be treated as icy surfaces with appropriate operating techniques and precautions applied. Contact base operations or weather for current runway conditions. If windshields are pitted beyond use, perform an instrument approach with a safety chase. Request the widest runway and declare an inflight emergency.

Additional precautions should also be taken. Damaged landing lights will significantly reduce landing light effectiveness; therefore, have the runway lights (not strobes) turned full up. Limit reverse thrust to the minimum practical after landing. Minimize ground operations and taxi thrust. Consider clearing the active runway and having the aircraft towed.

Finally, if you inadvertently fly into ash, or suspect you have, make an appropriate entry in the 781A. Record altitude, location, duration of exposure, and any related malfunctions observed.

There are several maintenance considerations to think about following exposure to volcanic ash. Aircraft inspections should be conducted in accordance with technical orders. Start with removing ash at the earliest opportunity. Do not wipe, rub, or walk on ash-coated surfaces. Instead wash them using alkaline detergent, since ash is acidic, and flood with water. It is also a good idea to frequently check air, oil and fuel filters, and electrical generators and reduce the time between oil change intervals. Clean and/or replace air conditioning water separator bags. Pitot static systems should be cleaned by reverse blow out. Externally lubricated mechanisms like control cables, actuator rods, etc., should be wiped with a soft cloth. Avoid the use of solvents. Increase sumping frequency of fuel tanks. Increase inspections for landing gear squat switch cables. Finally, consult the engine manufacturer for specific power plant maintenance items.

Periodically, we all read or hear on the news that another volcano is active somewhere in the world. As we continue operations on a global scale, it is critical that we are prepared for the hazards we encounter worldwide. Airborne volcanic ash is one of the more serious ones. As aircrew members become more familiar with the dangers and precautions outlined here, they will be better able to handle an ash cloud encounter and increase the likelihood of safely recovering their crews and aircraft.